

***Abstract***

A four terminal non-volatile transistor device. A non-volatile transistor device includes a source region and a drain region of a first semiconductor type of material and each in electrical communication with a respective terminal. A channel region of a second semiconductor type of material is disposed between the source and drain region. A floating gate structure is made of at least one of semiconductive or conductive material and is disposed over the channel region. A control gate is made of at least one of semiconductive or conductive material and is in electrical communication with a respective terminal. An electromechanically-deflectable nanotube switching element is in electrical communication with one of the floating gate structure and the control gate structure, and is positioned to be electromechanically deflectable into contact with the other of the floating gate structure and the control gate structure. When the nanotube switching element is in communication with both the control gate and the floating gate, the control gate may be used to modulate the conductivity of the channel region. The nanotube switching element may be formed from a porous fabric of a monolayer of single-walled carbon nanotubes. Under certain embodiments, the nanotube article is suspended vertically in relation to the horizontal substrate. Under certain embodiments, a release gate and release node are positioned in spaced relation to the nanotube switching element, and, in response to a signal on the release node, the release gate electromechanically deflects the nanotube switching element out of contact with the one of the control gate and floating gate. Under certain embodiments, the contact between the nanotube switching element and the one of the control gate and floating gate is a non-volatile state. Under certain embodiments, the device occupies an area of  $8F^2$ .